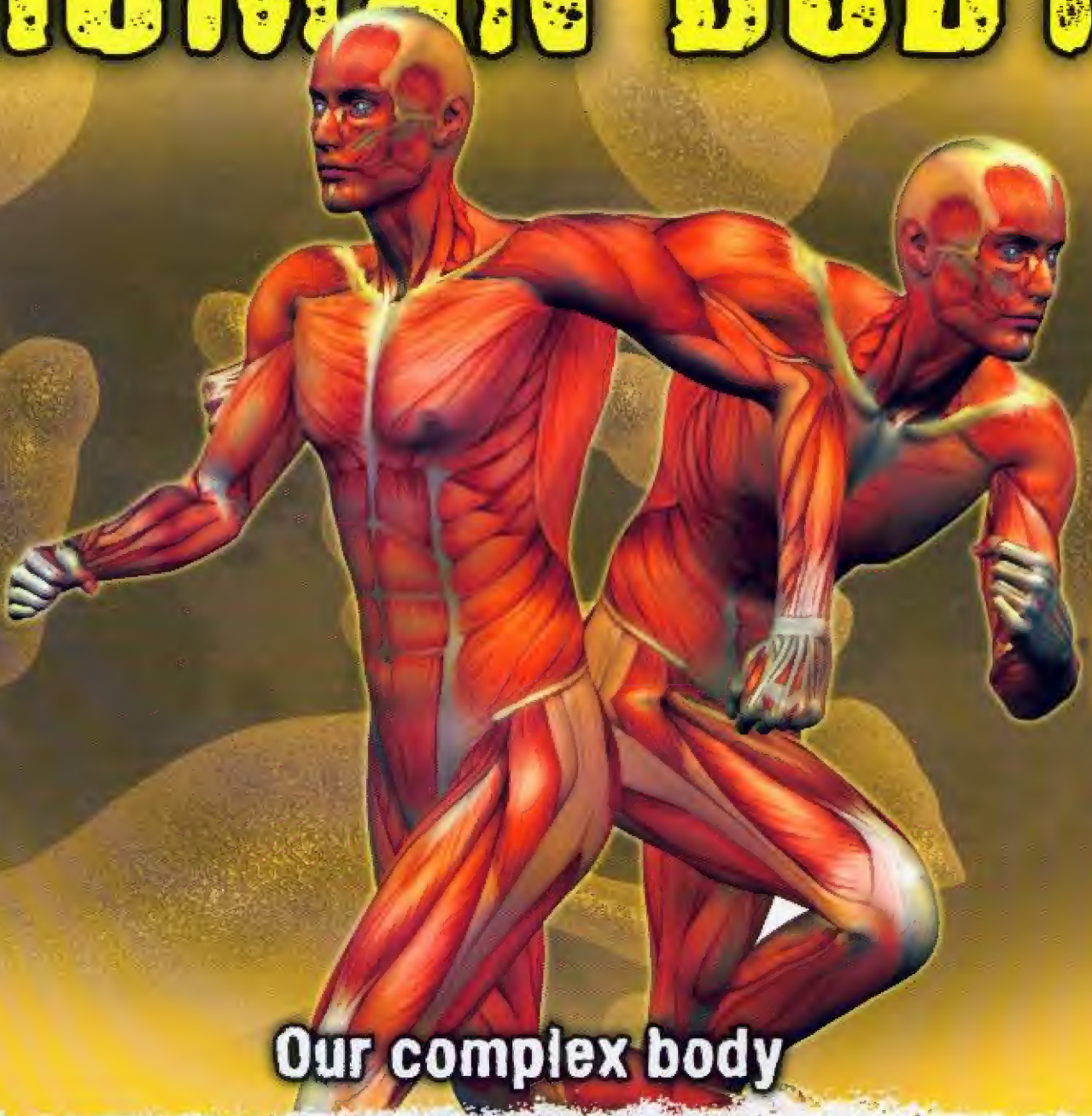


# HUMAN BODY

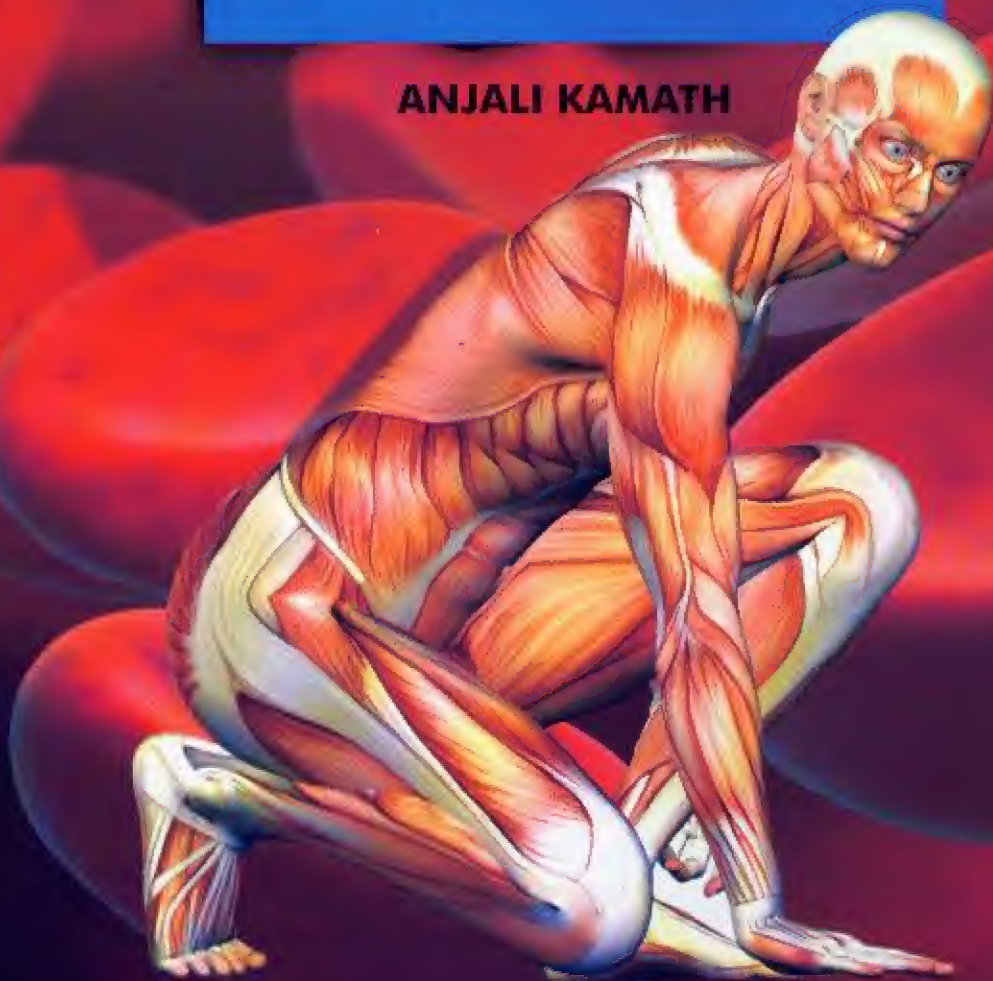


**Our complex body**



# HUMAN BODY

ANJALI KAMATH





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# Our Amazing Body

**You normally take your body and its organs for granted. It functions like clockwork day in and day out, and helps you perform hundreds of tasks, unless you fall sick or lose the use of one of its parts. Truly, the human body is a fantastic machine, so amazing that scientists have not unravelled all of its mysteries.**

## The building blocks

Your body contains trillions of tiny, microscopic cells. These cells come in different shapes and sizes. There are about 200 different kinds of cells. Each cell in your body has different functions – some protect from disease-causing bacteria, and some help carry oxygen to different parts of our body.

## Tissues and organs

Cells that have similar functions join together to form a tissue. There are four main types of tissues in our body – epithelial, connective, muscle and nervous tissue. These tissues form organs like liver, lungs, stomach and heart. Two or more organs that work together to provide a common function like respiration or digestion is called a system. There are ten major systems in our body. These are the skeletal, muscular, circulatory, nervous, respiratory, digestive, excretory, endocrine, reproductive and immune system.

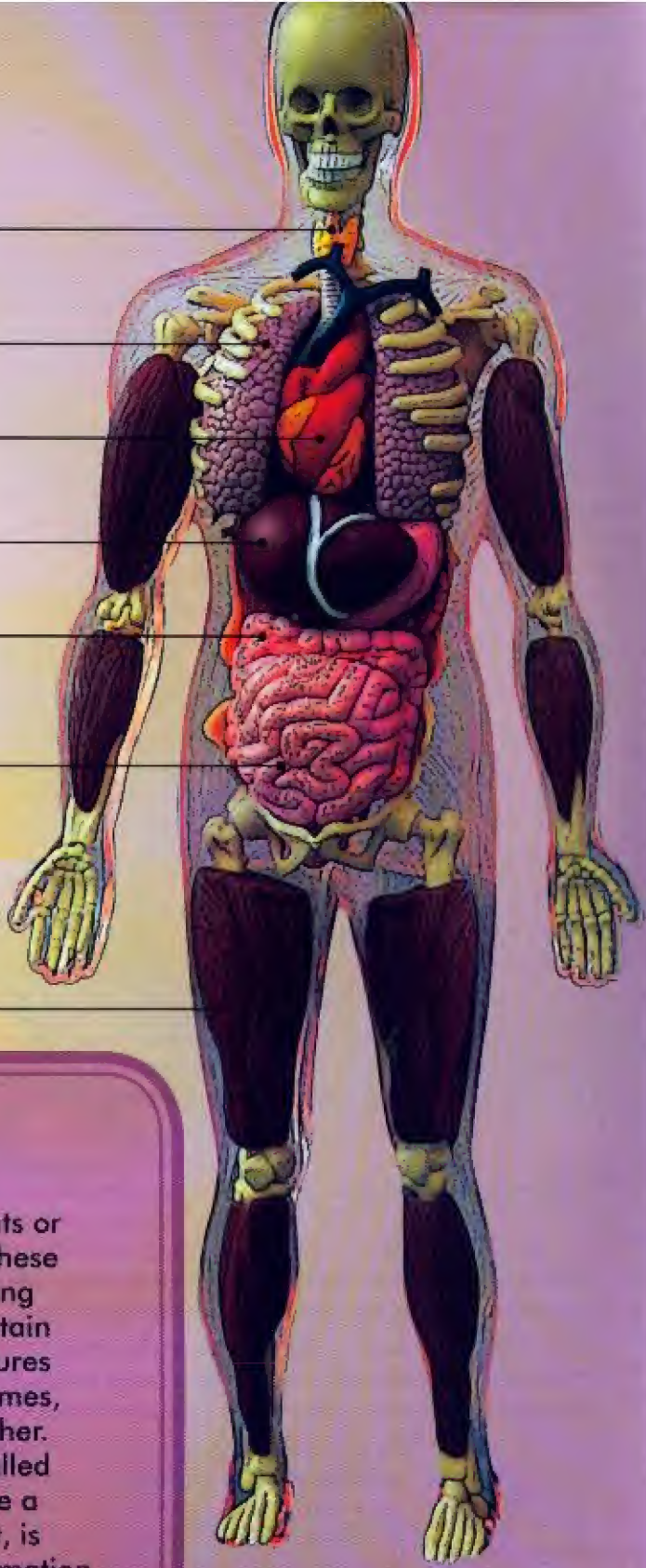


The nucleus of a human cell contains coil-like structures known as chromosomes.

## That's amazing!

If all the cells in a human body were joined at the ends, they would stretch for 1000 km – the distance between Paris to Rome!





Bones

Lungs

Heart

Liver

Large Intestine

Small Intestine

Muscles

### It's in your genes

A human cell consists of several compartments or organelles. A plasma membrane surrounds these organelles. The organelles can be seen floating in a fluid called cytoplasm. The cells also contain nucleus. Inside the nucleus lie coil-like structures called chromosomes. You have 46 chromosomes, half from your mother and half from your father. Chromosomes are made up of a chemical called DNA (Deoxyribonucleic acid), which looks like a spiral staircase! The DNA, like the fingerprint, is unique to a person and contains all the information.

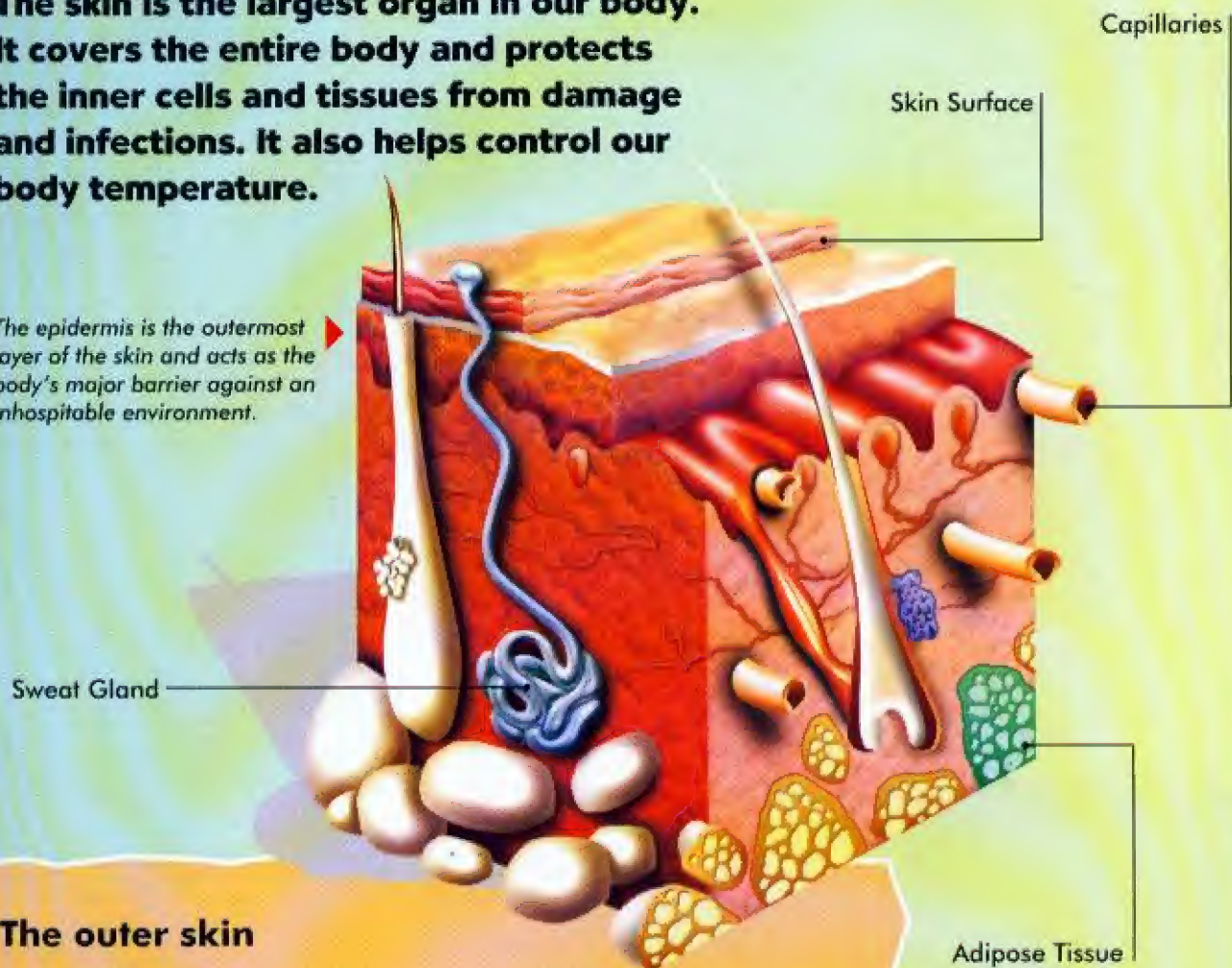
▲ The bones and muscles along with lungs, heart, liver and intestines are the vital parts of the human body.



# Skin

**The skin is the largest organ in our body. It covers the entire body and protects the inner cells and tissues from damage and infections. It also helps control our body temperature.**

*The epidermis is the outermost layer of the skin and acts as the body's major barrier against an inhospitable environment.*



## The outer skin

The skin is made up of an outer layer called epidermis and an inner layer known as dermis. The epidermis is made up of a thin layer of dead cells that are replaced continuously. When the dead cells wear away, new cells are formed. The epidermis contains a substance called keratin, which makes it tough and waterproof. The dermis contains follicles, or shafts, from which hair grows. It also contains sebaceous glands, which produce an oily substance called sebum. This substance keeps the skin from becoming dry. Sweat glands excrete water and salt from the body and are situated in the dermis. This layer also has sensory nerves, which help the skin to feel sensations and changes in temperature.



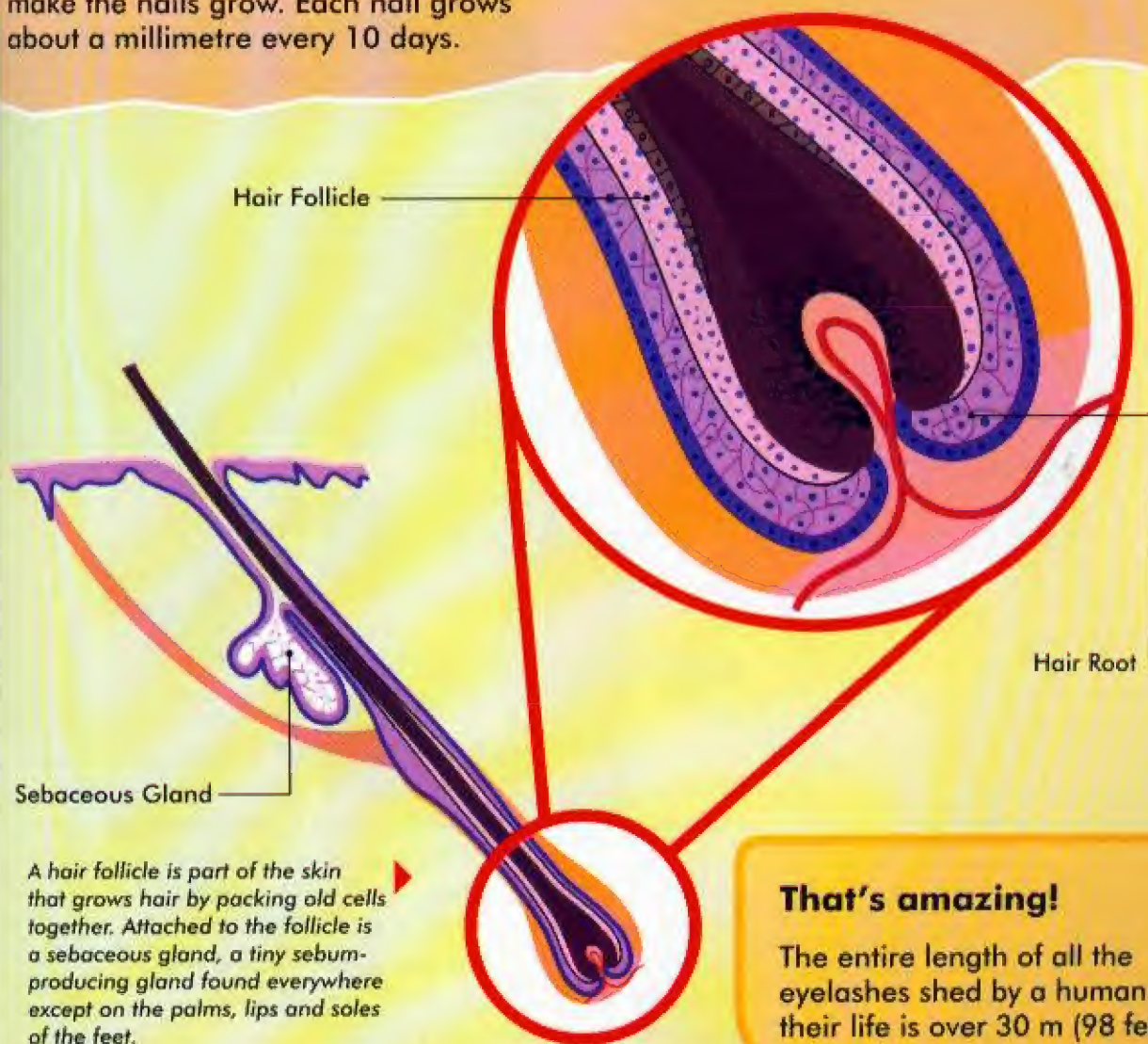
## Hair and nails

Like the skin, your hair and nails are also made of keratin. Each hair is born in a tiny pit called a follicle. Hair gets its colour from melanin.

Like your hair, nails too are made up of dead cells. The nails on fingers and toes are attached by their roots, which fit into grooves in the skin. Nails are flexible. The roots of nails produce new cells, which make the nails grow. Each nail grows about a millimetre every 10 days.

## The colour of your skin

Your skin gets its colour from a pigment called melanin, which is produced by a network of special cells called melanocytes. These cells also help the skin from harmful sun rays. People are darker in the warmer regions because their skin produces more melanin to protect them from harsh sunlight.



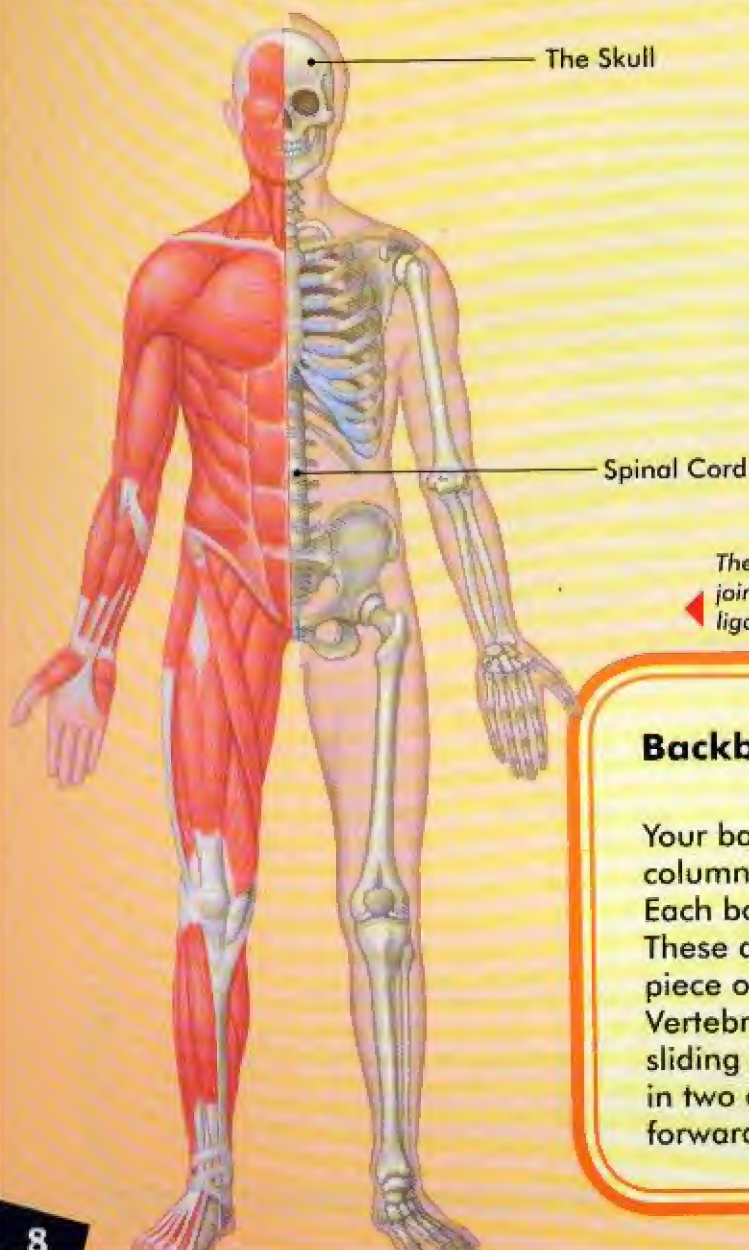
### That's amazing!

The entire length of all the eyelashes shed by a human in their life is over 30 m (98 feet).




# The Skeletal System

The skeletal system is made up of the skull, the backbone, the ribcage, the shoulder and hip girdles, and the bones of the arms and legs. It is the skeleton that gives our body its shape. The skeleton of an adult human consists of 206 bones. It not only provides our body shape, but it also helps us move and protects our internal organs from injuries.



## Skull

The skull is a hard shell made up of 28 bones fused together. It gives shape to the face and protects the brain. The only skull bone that is not completely fixed is the jawbone. The jawbone is hinged below the ear, so it can move up and down easily.

 The human skeleton system consists of joint and individual bones supported by ligaments, tendons and muscle.

## Backbone

Your backbone is otherwise called the spinal column or spine. It protects the spinal cord. Each bone in the spine is called a vertebra. These are cushioned from each other by a piece of cartilage called a vertebral disc. Vertebrae interlock with each other in sliding joints. You can move your backbone in two directions only – backwards and forwards, and from side to side.



### That's amazing!

The hyoid bone is a small U-shaped bone in the neck that supports the tongue. It is the only floating bone in the body, meaning the hyoid is not attached to any other bone in the body. Instead, it is supported by the neck muscles.

*Most children have a full set of 20 milk teeth when they are three years old. As soon as they reach the age of five or six, these milk teeth fall, making way for adult teeth.*

### Teeth

Teeth are a part of the skull. Every tooth comprises the root that anchors it in the jawbone and the visible part called the crown. Teeth are covered with enamel, which is the hardest substance in the human body. A baby has about 20 teeth by the time he is two years old. These are called milk teeth, and start to fall at about the age of six. The milk teeth are replaced by a set of permanent teeth. If you allow food to remain stuck in your teeth for a long time, the bacteria in your mouth feed on it. In the process, the bacteria destroy the enamel, causing a 'hole' in your tooth. This is called a cavity. Brushing and flossing your teeth regularly can prevent cavities.





# Bones

**Bones are hard on the outside and spongy on the inside. This reduces their weight.**

Structure of bone tissue

## What are bones made of?

Bones are formed by tiny bone cells called osteocytes and are made stronger by non-living materials like calcium and phosphorus. A thin membrane called periosteum covers the surface of the bones. Bones can be long or short and flat or irregular in shape. Long bones have a cavity filled with bone marrow. The blood cells in our body are produced in the bone marrow.

◀ Bones are a hard mixture of calcium salts deposited around protein fibres. Minerals make bone rigid and proteins provide strength and elasticity.


## When bones break

A fracture is a break or a crack in the bone. The bone must be repaired. A doctor will firmly fasten your bone in a plaster so that it sets easily. A few days after the fracture, certain cells in the damaged area form a fibrous network. Then cartilage is produced which is in turn converted to bone by repairing cells called osteoblasts.




## Joints


Bones are stiff and cannot bend. We can bend our arms and legs because bones meet at joints, which are flexible. The main types of movable joints in the human body include pivot, hinge, and ball and socket joints. Pivot joints allow the bone to rotate and move up and down. Hinge joints allow the bone to move up and down, or backward and forward. Ball and socket joints are the most flexible and allow the bone to move in many different ways. The fixed joints, like those in the skull, do not move at all.



▲ The largest and most complicated joint in the human body is the knee.



▲ The elbow is the region surrounding the elbow-joint. Three bones form the elbow joint.



▶ The skeletal system protects the vital organs of the human body.

### That's amazing!

The femur or thighbone, which is the longest bone in the body grows up to 50 cm (20 inches).



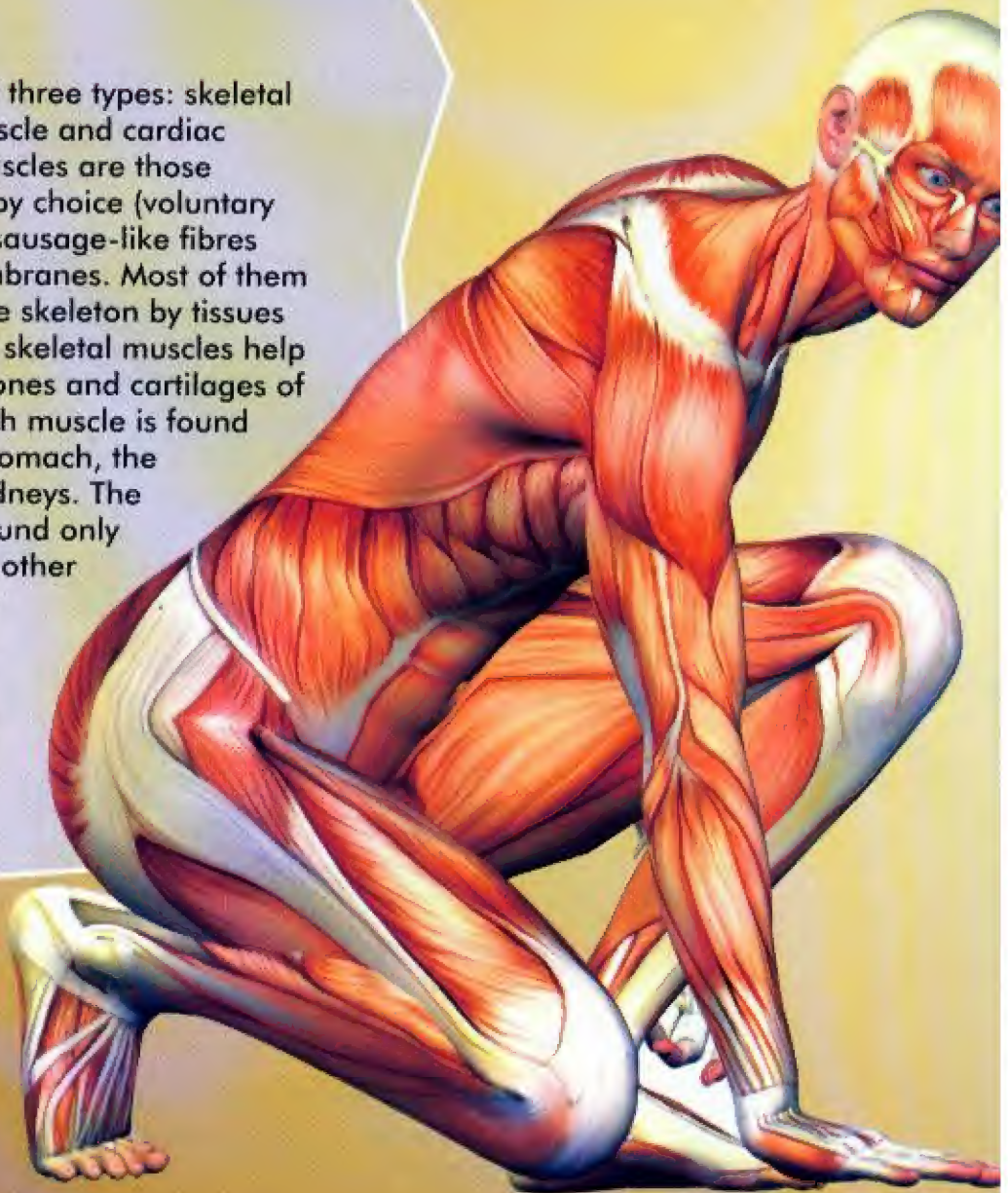
# Muscles

**You can hop, skip, blink and even breathe because of your muscles. Your body has more than 600 muscles. Gluteus maximus, the muscle in our buttocks is the largest muscle in the body.**

## Muscle types

These are mainly of three types: skeletal muscle, smooth muscle and cardiac muscle. Skeletal muscles are those that you can move by choice (voluntary muscles). They are sausage-like fibres surrounded by membranes. Most of them are connected to the skeleton by tissues called tendons. The skeletal muscles help move the various bones and cartilages of the skeleton. Smooth muscle is found in organs like the stomach, the intestine and the kidneys. The cardiac muscle is found only in the heart. Unlike other muscles in the body the cardiac muscle never gets tired. It constantly works to pump blood in and out of the heart.

Muscle cells contain filaments that contract and move past each other. They are classified as skeletal, cardiac, or smooth muscles.





## How muscles work

Skeletal muscles work in opposing pairs such as the biceps and triceps in your arm. When you raise your arm, the biceps **contract** and shorten while the triceps expand. The opposite happens when you lower your arm. Muscles have cells that help them expand and contract. These cells use chemical energy from the food you eat to do this.

## Facial muscles

Human beings have more facial muscles than any other animal. These muscles are arranged in flexible sheets that overlap each other. Unlike other muscles, facial muscles are attached to other muscles or to the skin, this allows us to make a number of different expressions.

*The skeletal muscles located in the arms work in opposing pairs.*

## That's amazing!

Eye muscles are the busiest muscles in the body. Scientists estimate they may move more than 100,000 times a day!



# The Heart

**The circulatory system is a complex network of delicate tubes that carry blood to all parts of the body and back to the heart. It consists of the heart, arteries, veins and capillaries. The heart pumps oxygen-rich blood throughout the body. It also sends the blood with less oxygen to your lungs. Arteries and veins, carry blood to the heart and back.**

## Structure of the heart

Your heart has four chambers. The upper two chambers, called atria or auricles, receive blood from the veins. They are joined to two lower chambers called ventricles. These are the pumps of your heart. The right ventricle pumps blood that needs oxygen to the lungs and the left ventricle pumps oxygen-rich blood to the entire body.

## How the heart works

Blood containing carbon dioxide is brought to the heart by the superior and inferior vena cava, or 'heart veins'. This blood enters the right atrium. When the atrium is filled, the valve opens and the blood flows down into the right ventricle. From here, the blood is sent to the lungs through the pulmonary artery. The lungs breathe out the carbon dioxide that comes with the blood and breathe in oxygen. The oxygenated blood re-enters the heart, into the left atrium, through the pulmonary veins. When the atrium is full, the valve connecting it to the left ventricle is opened and the clean blood flows down into it. The blood is then sent out into the body through the aorta, the body's largest artery.



▲ People sometimes talk about the heart as the place responsible for feelings. But feelings are really sensed in the brain. The heart only helps us feel by giving blood to the brain.



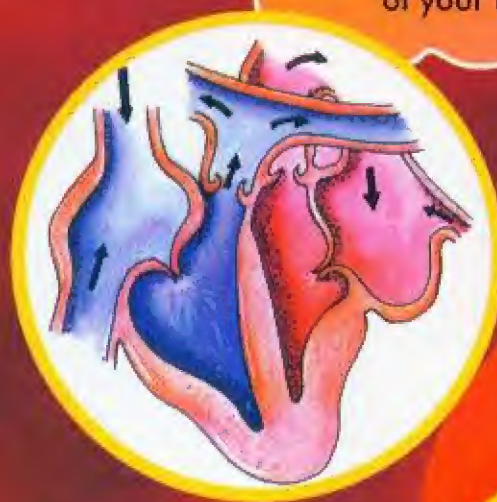
## That's amazing!

Every square inch (2.5 cm) of human skin consists of 6 m (20 feet) of blood vessels.

Veins are the blood vessels that carry blood from the body to the heart. Arteries are the blood vessels that carry blood away from the heart to the body.

## Systole and diastole

There are two stages in a heartbeat – the systole and the diastole. Systole is when the heart pumps blood into the arteries. In this the walls of the ventricles contract. This raises the blood pressure inside the ventricles and the blood flows into the arteries. During diastole the muscles of the ventricles relax. The decrease in the pressure causes the one-way valve in the heart to open. Meanwhile the atrium contracts forcing blood through the opening into the ventricles. This is how your heart pumps blood into other parts of your body!



◀ In the systolic phase, the heart contracts. As a result, blood pressure rises and blood moves out through the vessels.



▶ In the diastolic phase the heart relaxes. As a result, blood pressure falls and blood fills the heart.



# Blood

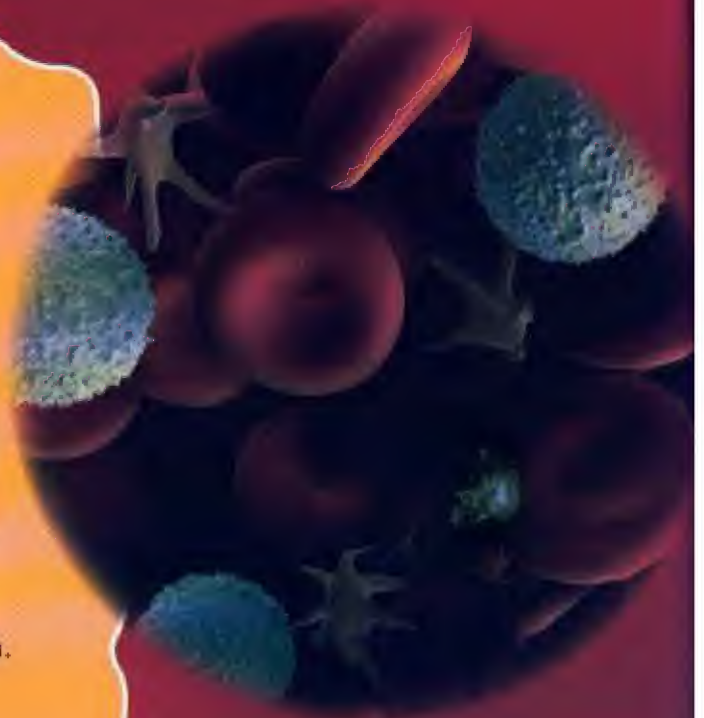
**Blood is the source of life for all human beings and animals. It is the vehicle in which food, water and oxygen are sent to all parts of the body. An average human being has about five litres of blood circulating in his or her body.**

## Composition of blood

Blood mostly consists of a yellow fluid called plasma. The rest is made up of red blood cells (erythrocytes), white blood cells (leukocytes) and cell fragments called platelets (thrombocytes). Proteins, hormones, salt and water are dissolved in the plasma. Red blood cells are composed of a protein called haemoglobin, which absorbs oxygen as blood passes through the lungs and releases it to the rest of the body. Blood cells are produced in the bone marrow, specifically in the spine, ribs, hips, skull and the breastbone (sternum). The white blood cells fight disease and infection.

## Blood types

Although human beings have the same kind of blood, there are some differences that can only be seen under a microscope. Based on these differences, blood has been divided into four groups – A, B, AB and O. Some people have a certain blood protein present in their blood. This is called the Rhesus, or Rh, factor. Blood types that have this blood protein or the Rh factor have a + sign and those that do not, have a - sign, for example A+ or A-, O+ or O-, and so on.



▲ White blood cells, or leukocytes, are cells of the immune system defending the body against infectious diseases.



## Blood vessels

Arteries, veins and capillaries together are known as blood vessels. Arteries are large, strong and thick-walled blood vessels that carry oxygen-rich blood from the heart to the rest of the body. Veins are smaller and thinner blood vessels that carry blood deficient in oxygen back to the heart. Capillaries are fragile blood vessels that are found throughout the body – they connect the arteries and veins. The capillaries are so thin that blood cells travel through them in a single file. Oxygen in the blood is passed into the tissues through the thin walls of the capillaries. Similarly, carbon dioxide and other chemical wastes also pass into the capillaries to be taken away.

◀ The blood's red colour is due to the colour of haemoglobin

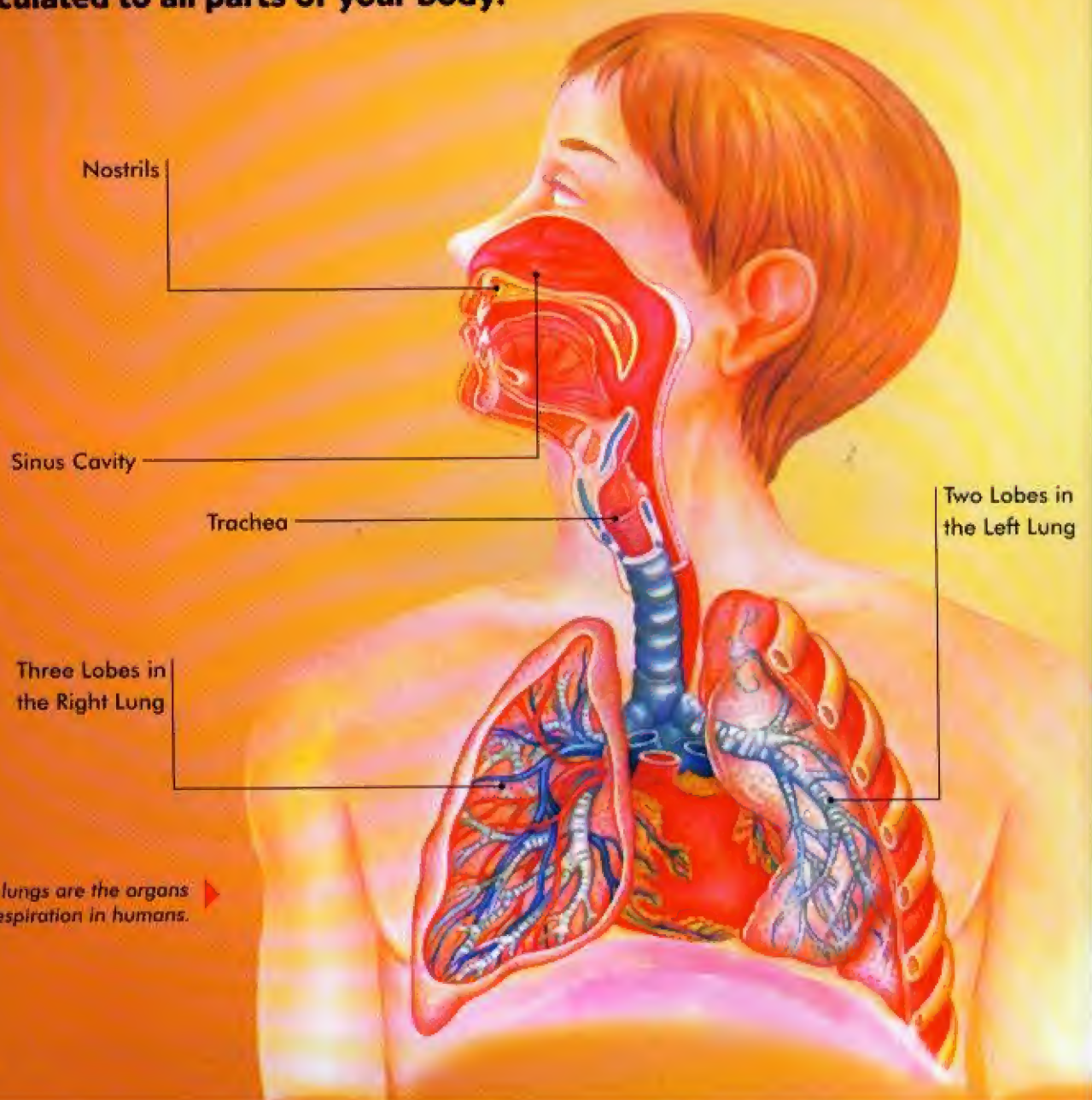
## That's amazing!

Platelets are the smallest cells in the blood and cannot live longer than ten days.



# The Lungs

**Your body needs oxygen to survive. You get this oxygen from the air you breathe. This involves a very complicated process in which, the lungs play a vital role. Your lungs are large spongy organs that occupy most of the chest cavity. When blood passes through the lungs, oxygen is absorbed by the haemoglobin and circulated to all parts of your body.**





### That's amazing!

You breathe over six litres (1.32 gallons) of air every minute.

Lymph Node

Right Lung:  
Upper Lobe  
Middle Lobe  
Lower Lobe

Left Lung  
Upper Lobe  
Lower Lobe

◀ Your lungs are protected by your rib cage, which is made up of 12 sets of ribs. These ribs are connected to your spine in your back and go around your lungs to keep them safe.

### Inside the lungs

The air that you breathe through the nose and mouth enters the trachea or windpipe. The trachea in turn divides into two tubes called bronchi that further branch out into smaller tubes inside the lungs. These tubes end in tiny bubbles or sacs called alveoli. There are about 600 million alveoli in your lungs, it helps to pass on the oxygen from freshly inhaled air to your bloodstream. They also exchange it for waste products such as carbon dioxide that has been produced in the body.

### How you breathe

You take air in about 20 times in a minute. When you take air in (inhale), the muscles around your rib cage thrust your ribs out and lower the dome of your diaphragm, increasing the space in your chest. This, in turn, decreases the air pressure inside the lungs and air flows into your lungs. When the muscles relax, the ribs and the diaphragm return to their original position, decreasing the chest cavity. This causes your lungs to push out the extra air inside. This is called exhale.

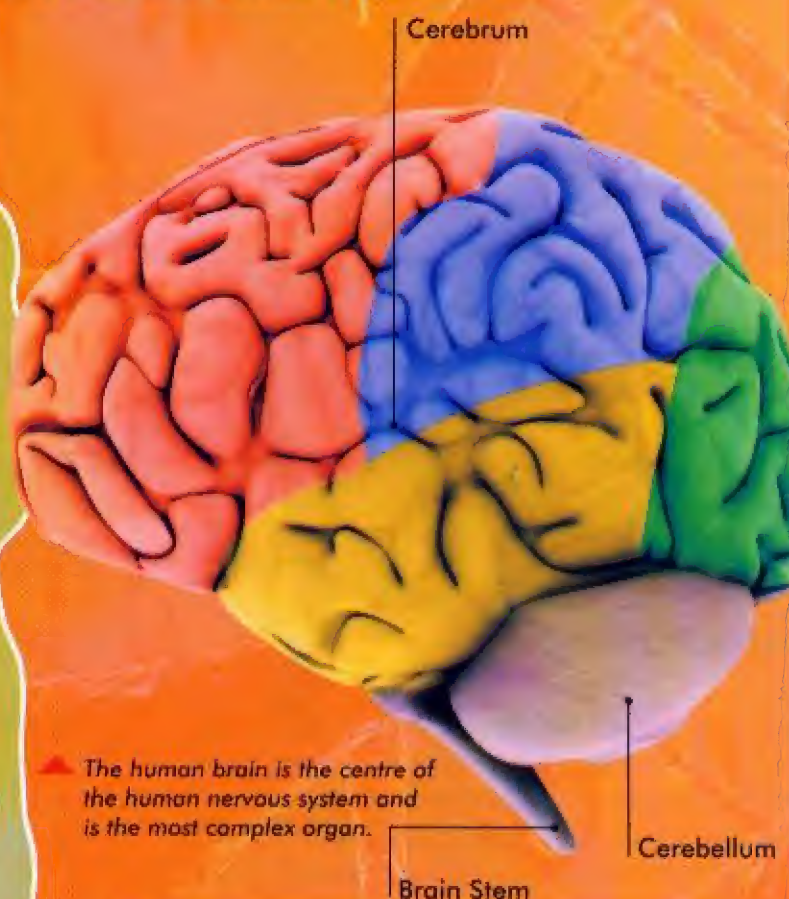


# The Nervous System

Have you ever wondered how you are able to see, hear and respond to all that happens around you? It is made possible by a huge network called the nervous system. The nervous system is the messaging system of the body. The brain and spinal cord are the most important part of this system, and are together called the central nervous system. They are supported by millions of nerves and the sense organs – ears, eyes, nose, tongue and skin.

## The brain

The human brain is only about two percent of the body's weight, but it is responsible for every activity that we do, every thought, every memory and every skill we develop. The brain is located in the skull. It is protected by the cerebrospinal fluid that surrounds it and fills all the chambers within it. The brain consists of three parts – cerebrum, cerebellum and brain stem. The grey outer part of the cerebrum is called the cortex. This is where information from other parts of the body is received. Within the cortex is a large white matter, which sends messages to the other parts of the body. The cerebrum is divided into several sections and each section communicates with a particular sense organ. Below the cerebrum, towards the back, is the cerebellum. This part of the brain controls our body movements.



## That's amazing!

A newborn baby's brain grows almost three times in course of the first year!





## The Brain stem and diencephalon

The brain is connected to the spinal cord through the brain stem. All **involuntary** activities like breathing, heartbeat and digestion are controlled by the brain stem. It also takes messages from the brain to the spinal cord.

The diencephalon is found on top of the brain stem and consists of the thalamus and the hypothalamus. The thalamus receives information from the sense organs and sends it to the appropriate part of the brain. The hypothalamus maintains the body conditions by controlling thirst, hunger and body temperature.

◀ The Central nervous system contains the majority of the nervous system and consists of the brain and the spinal cord.

## Hormones

The endocrine glands play an important role in the nervous system. These glands release chemicals called hormones, which travel to the brain and other parts of the body and affect our body functions. There are eight major glands in the human body. Some glands are present only in men and others only in women. Hormones affect the growth of bones and muscles, the balance of minerals and chemicals in the body, and reproduction.



# The Spinal Cord And Neurons


**Apart from the brain, the spinal cord and nerve cells are also important to the nervous system. The spinal cord is responsible for reflex actions, while the nerve cells or neurons receive and carry messages to your brain and different parts of the body to perform various actions.**

## The spinal cord

The spinal cord is a bundle of nerves and is around 40 cm long. It is connected to the brain and extends down the backbone. Messages are conveyed to and from the brain through the spinal cord. In certain cases the spinal cord too conveys messages. For example, if you touch something hot, your hand moves away automatically. You blink when there is too much light. These are reflex actions. Most of these reflexes do not travel to your brain. Instead your spinal cord sends out the necessary messages. That is why they take place so quickly!


## Nerve cells

Nerves carry information from all parts of the body to the spinal cord and the brain, and send messages back to the organs. They are made up of several million cells, called neurons. Each nerve cell consists of a cell body with a nucleus. Short branches of the cell called dendrites receive signals from other neurons, while a tube-like axon transmits these signals to other cells. Messages are carried in the form of electrical signals or nerve impulses.



◀ The spinal cord is about 45 cm long in men and 43 cm long in women.






The spinal cord helps us move backward, forward and also side to side.

## Pain spots

You feel pain when your free nerve endings are damaged. Free nerve-endings in your skin may pick up a 'sensation' or 'stimulus' and send the message up the spinal cord to the brain. The points on the skin that respond to stimuli with a sense of pain are called 'pain spots'. These spots are not evenly distributed in the body. Some places might have fewer pain spots than others.

## That's amazing!

The length of all your nerves put together would be 72 km (45 miles)!

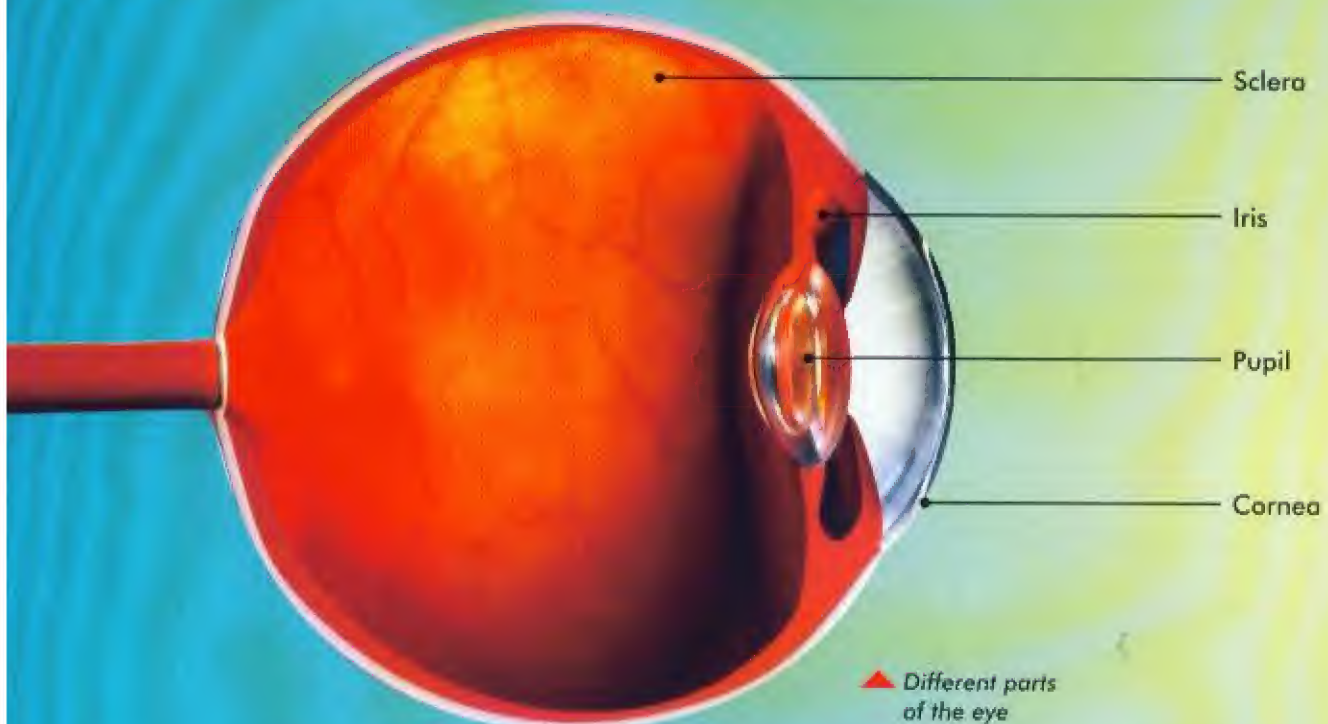


Neurons come in many different shapes and sizes. Some of the smallest neurons have cell bodies that are only 4 microns wide. Some of the biggest neurons have cell bodies that are 100 microns wide.



# The Eyes

**There are five sense organs in the human body.  
They include the ear, nose, eyes, skin and tongue.  
Your eyes help you see the world around you.**



## Parts of the eye

The eye is located in a small hollow area in the skull called the eye socket. The outer part of the eye is protected from dust and infections by your eyelids and lashes. The white portion of the eye is called the sclera, while the coloured part is the iris. Muscles attached to the iris help it to control the amount of light that enters the eye. The small black circle in the middle of the iris is an opening called the pupil. Light from objects enter the eye through the pupil. A transparent membrane called cornea covers the iris. The cornea helps your eye focus. A colourless lens located behind the iris helps focus the light entering the pupil on to the retina at the back of the eye. The retina contains nerve cells that send signals to the brain to help you see.





◀ Your eyes are at work from the moment you wake up to the moment you go to sleep.

## How you see

The eyes convert the light waves and the ear converts sound waves into nerve impulses before sending them to the brain. You see an object when the light bouncing off the object, enters your eyes. Light rays enter the eye through a small opening called the pupil. They are then focussed by the lens to form an image on the retina. Cells sensitive to light trigger nerve signals that travel to the brain. The picture formed on the retina is upside down, but the brain turns it the right way up.

## Rods and cones

There are two kinds of light cells. They are rods and cones. Rods help to see shades of grey and in the night. Cones on the other hand detect colours.

Wearing glasses helps in short-sightedness as well as long-sightedness problems of the eye. ▶



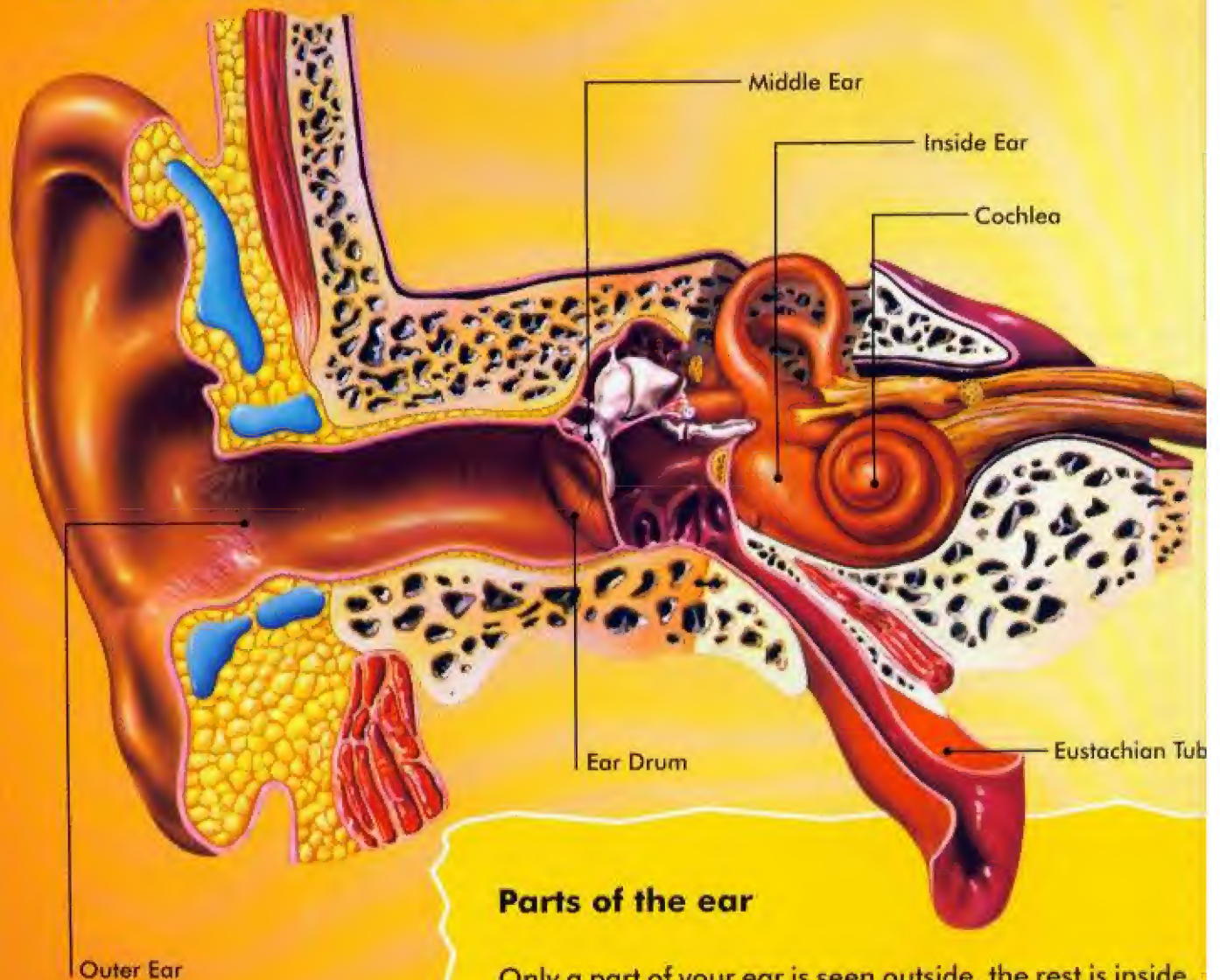
## That's amazing!

Male eyes are about 0.5 mm bigger than female eyes.



# The Ear

**Your ear is an important sense organ. It helps you hear.  
Ear also helps you to maintain balance.**



## Parts of the ear

Only a part of your ear is seen outside, the rest is inside. The outer ear has a flap called the pinna and the ear canal. The middle ear consists of three tiny bones—the hammer, the anvil and the stirrup. The eardrum separates the outer and middle ear. The inner ear contains the spiral shaped cochlea, the vestibule and three fluid-filled semicircular canals that help maintain your balance.



### That's amazing!

The stapes or stirrup in the middle ear is the smallest bone. It is about the size of a grain of rice. It is only 0.18 cm (0.07 inches) long.

### How we hear

The ear flap directs sound waves into the ear canal. The waves then bounce off the eardrum making it vibrate. The three tiny bones magnify the sound vibrations and send them to the cochlea. Millions of tiny hair then convert these vibrations into electric signals that are sent to the brain.

Ears help us hear and enjoy music by converting the sound waves into electrical signals that are then sent to the brain.





# Smell, Taste And Touch

**The other three sense organs are the skin, nose and tongue. Although your sense of smell is stronger than your sense of taste, these two actions are closely linked to each other. During a bad cold for instance, even the most delicious food feels tasteless because you are unable to smell the aroma of the food!**

## Nose and tongue

Your nose has special nerve endings at the back that are called olfactory receptors. When a smell dissolves in the mucus inside your nose, the hair on the receptors take it in. This excites the receptors, which then send a message to the brain through a nerve called the olfactory nerve. Your tongue is covered with taste buds. Each of these taste buds contains several receptors with tiny hair that feel the food. Every taste bud can make out different tastes such as: sweet, sour, bitter and salty. Your tongue also plays a vital role in speech by helping to form words.

## When the mouth waters

Saliva is a watery liquid secreted by glands present in the mouth. It moistens the food and starts the process of digestion even before the food is swallowed. Taste buds only work on the chemicals in food after it has been dissolved by the saliva.





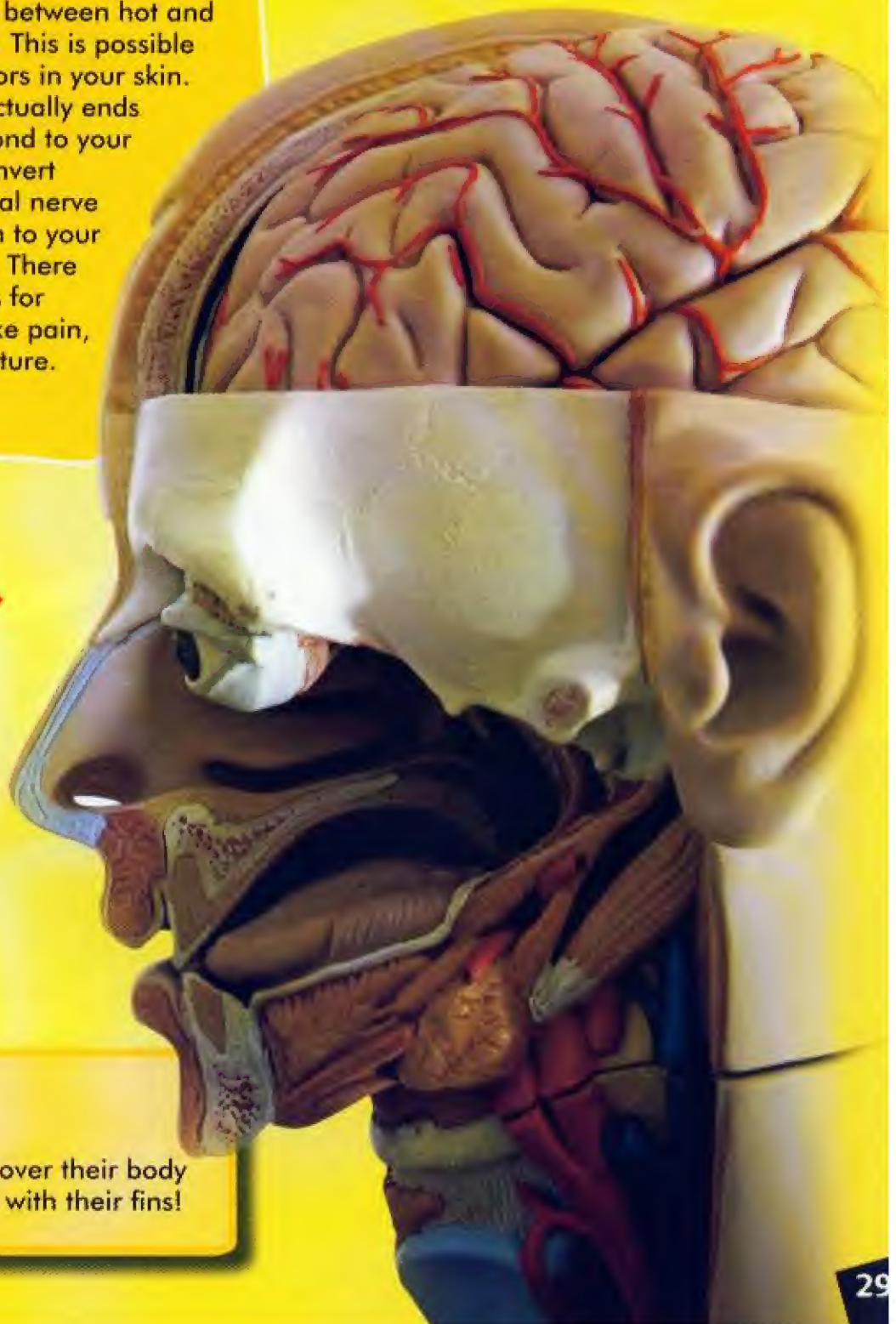
## Skin

Your sense of touch includes responses to pain, pressure and temperature. You can tell the difference between hot and cold, and wet and dry. This is possible because of the receptors in your skin. These receptors are actually ends of nerves, which respond to your environment. They convert touch into tiny electrical nerve signals and send them to your spinal cord and brain. There are different receptors for different sensations like pain, pressure and temperature.

There are five senses that the brain uses to gather information about the world around it.

## That's amazing!

Fish have taste buds all over their body – so they can taste even with their fins!





# Digestion

**Food has to be broken down into small particles before the body can absorb its energy and nutrients. The process of breaking down food is called digestion and it takes place in the digestive tract. The tract includes the mouth, food pipe, stomach, intestines and the anus.**

## Stomach

Digestion begins the moment you put food in your mouth. Your teeth grind the food into small pieces and the saliva moistens the food making it easier to swallow. A chemical in the saliva also helps to break down carbohydrates. The food is carried through the food pipe or oesophagus into the stomach. The stomach produces acidic digestive juices that mix with the food to produce a creamy mixture called chyme.







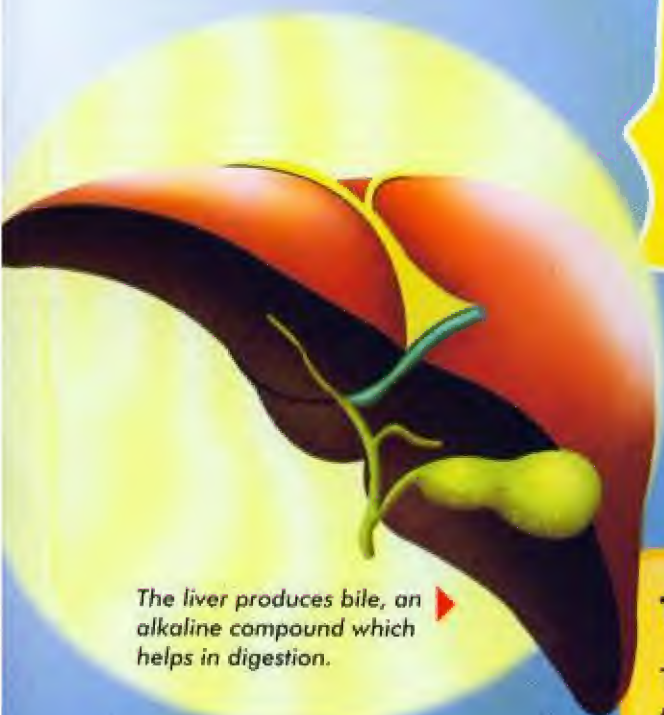
▲ The small intestine and the large intestine help in the digestion process of human body.

### In the intestines

When the food enters the small intestine, bile from the liver breaks down fat, while pancreatic juices break down sugars and starch. Finally, the enzymes in the small intestine complete the process. The nutrients that are broken down are then absorbed through the walls of the small intestine and carried into our bloodstream. The rest of the undigested food is sent to the large intestine, where some of the remaining nutrients like water and salts are absorbed. The rest of the waste matter is then stored in the rectum until it is excreted from the body.

### Liver

The liver is the largest internal organ, and probably one of the busiest. It processes sugar and fats for storage, manufactures bile for digestion and it contains a reservoir of blood, which is released if the body loses too much.



The liver produces bile, an alkaline compound which helps in digestion. ▶

### That's amazing!

The digestive system is made up of a long tube, which starts at the mouth and ends at the anus. This tube, called the alimentary canal, is about 12 m (30 ft) long.



# Excretion

The body produces waste that cannot be used. These waste products are passed into your kidneys where it is expelled from the body along with excess water in the form of urine. The semi-solid waste is stored in the rectum and later expelled from the body through the anus.

## Rectum and anus

All the leftover that cannot be digested enters the large intestine. Here, water is reabsorbed causing the waste to harden. This is then stored in a part of the large intestine called rectum in the form of stool. The stool is pushed into the anus and comes out by the contraction of the muscles in the rectum.

♦ All of us go to toilet to expel waste products from our body



## What's that smell?

Bacteria present in the intestines feed on the waste producing two chemicals called indole and skatole. These chemicals give the stool its bad smell.

Renal Medulla

Ureter

Interior Vena Cava

Aorta

## Kidneys

Kidneys are bean-shaped organs containing millions of small tube-like structures called nephrons. These nephrons filter out excess water, salt and other wastes from the blood, and reabsorb some of them. The rest is used to produce urine, which is then drained into tubes called ureters leading to the urinary bladder. When your bladder becomes too full, you feel the need to pass urine. The bladder can expand to hold almost a pint of urine. It also closes openings into the ureters, so that urine cannot flow back into the kidneys. The tube through which the urine flows out of the body is called the urethra.

## That's amazing!

About 190 litres of blood pass through the kidneys every day.

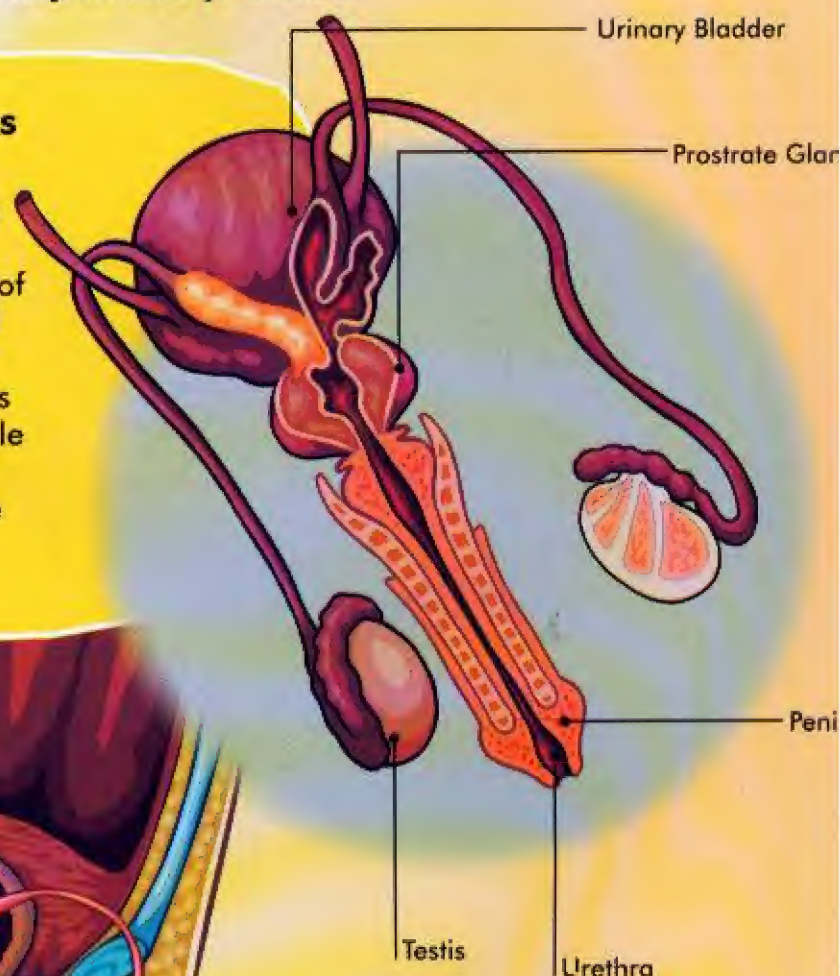


# Reproduction

**All living beings – plants or animals produce young ones. Humans too produce their young ones. This process is called reproduction. Both men and women have unique reproductive organs that help in this process.**

## Male reproductive organs

The male reproductive system is situated near the pelvic region, but outside the body. It consists of a pair of testes and their related ducts, and the penis. A sac-like cover called the scrotum protects the testes. They produce the male hormone called testosterone as well as sperm. Sperm leaves the testes and travel to the penis.



◀ The male sex organs work together to produce and release semen into the reproductive system of the female during sexual intercourse.

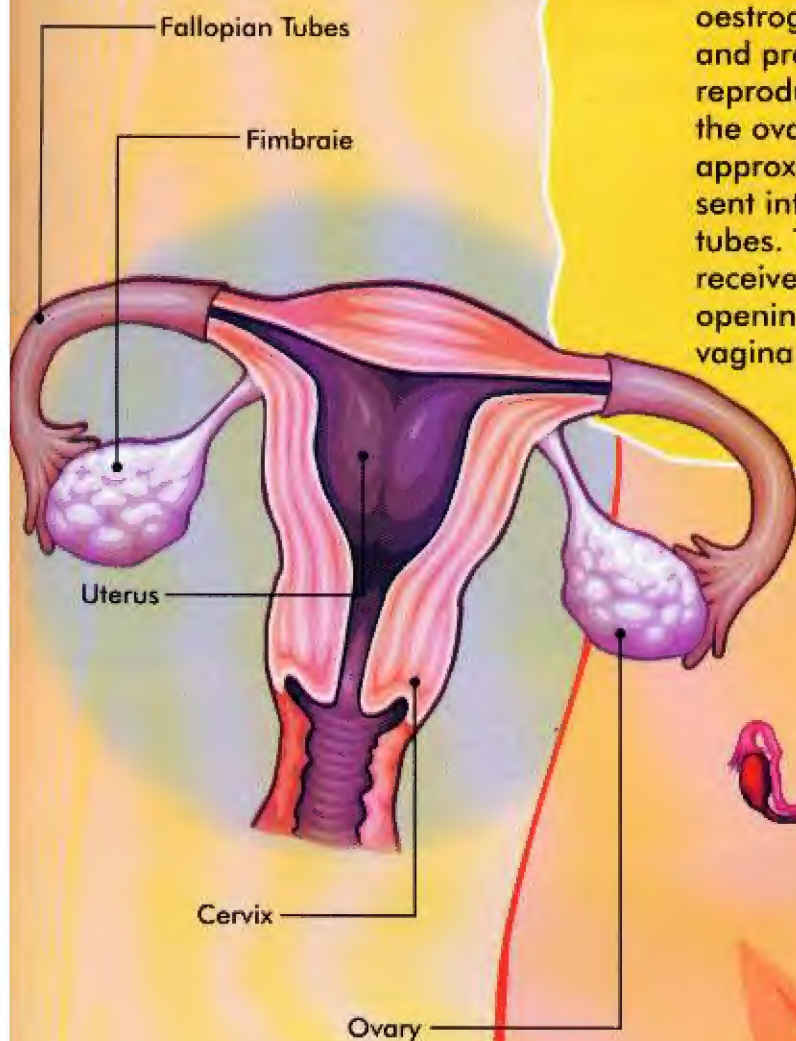


### That's amazing!

The ovum or egg is the largest cell in the human body. It is about 2 inches in diameter.

### Female reproductive organs

The female reproductive system is situated in the pelvic region. It consists of a pair of ovaries, the uterus, two fallopian tubes, the cervix and the vagina. The ovaries are the female endocrine glands – they produce oestrogen, the hormone that changes and prepares the body for adulthood and reproduction. With the onset of puberty, the ovaries begin to produce an egg approximately once a month. This egg is sent into the uterus through the fallopian tubes. The uterus is a sac-like organ that receives the egg. It is connected through an opening called the cervix to the vagina. The vagina provides a passage out of the body.



With the onset of puberty in a girl, the ovaries produce a hormone called oestrogen



# The Birth Of A Baby

When sperm enters the female body, many die, but those that survive travel through the uterus to the egg within the fallopian tubes. If a sperm is able to enter the egg, fertilisation takes place. The fertilised egg then attaches itself to the uterus wall and prepares itself for growth.

## Embryo

After fertilisation, the egg divides into morula or a ball of cells. Almost a week later they form a hollow ball called the blastocyst. Soon the blastocyst develops to form a placenta, umbilical cord and the developing baby or embryo inside the mother's womb. The baby gets its food and oxygen from the mother's bloodstream through the placenta that is attached to the baby's umbilical cord.

◀ In humans, an embryo is formed from the moment of fertilisation until the end of the eighth week, after which it is called a foetus.

## Amniotic fluid

Within the placenta, the embryo is cushioned in amniotic fluid. This is a watery liquid that contains proteins, carbohydrates and other energy-giving substances. Low or high levels of amniotic fluid may be dangerous for the embryo and in some cases can mean that it suffers from birth defects.





## Foetus

By the eighth week the embryo is 2.5 cm long. At this point it is called a foetus. It takes 12 weeks for the embryo to develop all the internal organs. During the last six months the baby starts to develop fingernails and hair. It starts to move, kick and suck its thumb. It can even tell light from dark! The baby is ready to be born after about 40 weeks or nine months. When the baby is to be born, the mother experiences labour pains as the muscles of her uterus contract, and the cervix dilates to push the baby out.

The seven stages of foetal development leading to childbirth.



### That's amazing!

A baby's head makes for about one quarter of its body length. When it reaches adulthood, the head is about one-eighth of the length of its body!



# The Human Lifecycle

**You begin life as a baby and slowly grow up over the years. When you are about six or seven years old, your milk teeth are replaced by a set of permanent teeth. You start to grow tall. As you reach puberty, you will see changes in your appearance. Usually, puberty starts between the ages of eight and 13 in girls and nine and 15 in boys.**

## Puberty

During puberty, endocrine glands release hormones that change the appearance of a person. The body grows and matures, and starts developing adult characteristics. In girls, the body develops breasts and the hips widen. Boys begin to grow body hair and their voices change. Male and female hormones are produced by special glands in the reproductive system.



▲ Infant



▲ Child



▲ Adolescent



▲ Adult



### **That's amazing!**

Beards are the fastest growing hair on the human body. If a man never trimmed his beard, it would grow to nearly 30 feet long in his lifetime.



▲ Old person

### **Puberty**

During puberty, endocrine glands release hormones that change the appearance of a person. The body grows and matures, and starts developing adult characteristics. In girls, the body develops breasts and the hips widen. Boys begin to grow body hair and their voices change. Male and female hormones are produced by special glands in the reproductive system.

### **Grandparents and old age**

Most of us have grandparents who are old and need care. They may appear shorter and weaker every day. There are reasons behind this change. As people grow older, they generally lose some muscle and fat from their bodies as part of the natural aging process. The vertebrae may degenerate and start to collapse into one another. As they start to press closer together, a person loses a little height becoming shorter.

### **Gonadotropin Releasing Hormone**

As puberty is about to begin, your brain releases a special hormone called Gonadotropin Releasing Hormone, or GnRH. When GnRH reaches the pituitary gland (a pea-sized gland just under the brain), it releases two more hormones - Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH). Both, boys and girls, have these hormones in their bodies.



# Falling Sick

When all our organs, systems, bones and muscles are working well, we enjoy good health. However, when any one of these has trouble, it affects other parts of the body as well – and we suffer from discomfort or disease.

## Why we fall ill

The human body is much like any other machine. It needs the right fuel, at the right time. It also needs to be exercised regularly and looked after well. We can fall ill for many reasons. Bad eating habits, no exercise, and lack of hygiene can cause several illnesses. An imbalanced or unhealthy diet slows down the working of our organs and results in diseases like diabetes and hypertension. Similarly, lack of exercise makes our bodies stiff and inflexible, and more prone to diseases like osteoporosis and spondylitis.

When one is down with fever, a thermometer is used to check the rise or fall in temperature of the patient.

The immune system is a complex network of cells and chemicals. Its mission is to protect us against foreign organisms and substances.







### **That's amazing!**

Doctors sometimes give tablets called placebos to treat illnesses. Placebos actually do not contain any medication. They just reassure the patient and make them believe that they will recover.

### **When germs attack**

Not all diseases are caused by carelessness alone. Sometimes we fall ill because of infectious, or disease-causing, viruses or bacteria entering our circulatory system. These may enter our bodies from others who are unwell, from stale and unhygienic food or water, or from our surroundings. The common cold, pneumonia and flu, as well as more life-threatening illnesses like cholera, tuberculosis and HIV/AIDS are all infectious diseases.

### **Diagnosis**

Early doctors treated patients after checking their pulse and the colour of their eyes and tongue. Today, doctors diagnose diseases using complex and more precise equipment like ultrasonographs, CT scanners and endoscopes. The endoscope, a slim instrument with a camera, is inserted into the body so that doctors can have a close look at the organs inside.



# Staying Healthy


**In order to stay healthy, we need to take good care of our body. We have to keep our body clean and free from germs. When we fall ill we sometimes have to take medicines to fight the germs.**

## Fighting illness

When infection and disease attack the body, its first response is to fight back. The body raises its temperature to kill the infectious bodies that have entered the blood stream. The white blood cells immediately start attacking to try to kill the infection. These cells even make special antibodies, or proteins, to match the infections and fight against them. However, the immune system is not always able to fight the illness by itself. Therefore, we help it by taking medicines. Medicines can be in the form of pills or syrup and contains chemicals that can help fight disease. Some medicines can be bought from supermarkets, while other, stronger ones must be bought at a pharmacy with a doctor's prescription.

## Vaccination

Some illnesses can be avoided by taking medication beforehand. This can be in the form of a vaccination. Vaccinations are injections containing weak bacteria that cause a particular disease. The injected bacteria immunise the body and prevent similar bacteria from attacking it. Diseases like measles, mumps, hepatitis and tetanus can be avoided by having a vaccination.



▲ Everyone knows what medicines are for - to make you feel better when you are sick.

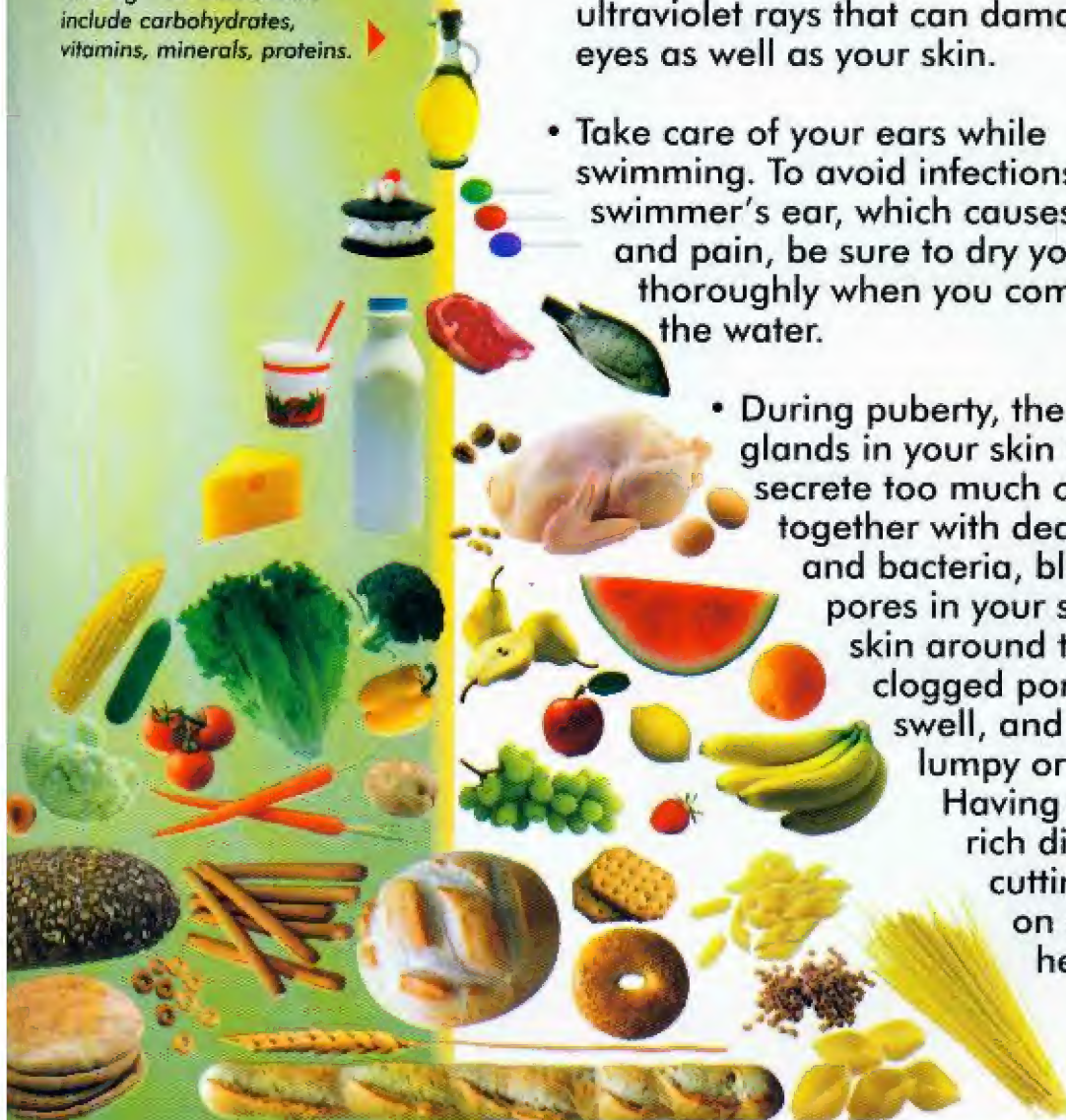


## Clean body, healthy body

There are many other ways to keep our body healthy so that we don't fall sick. Bathing is an essential part of this. We also need to take special care of our eyes, ears and skin. Here are a few things that we can do.

- Wear sunglasses and sunscreen lotions in bright sunlight. Sunshine contains ultraviolet rays that can damage your eyes as well as your skin.
- Take care of your ears while swimming. To avoid infections like swimmer's ear, which causes swelling and pain, be sure to dry your ears thoroughly when you come out of the water.
- During puberty, the oil glands in your skin tend to secrete too much oil. This, together with dead skin and bacteria, block the pores in your skin. The skin around these clogged pores can swell, and look lumpy or red. Having a fibre-rich diet, and cutting down on oily food helps a lot.

*Your body is a machine. You need different types of food to keep it up and running. The food should include carbohydrates, vitamins, minerals, proteins.*



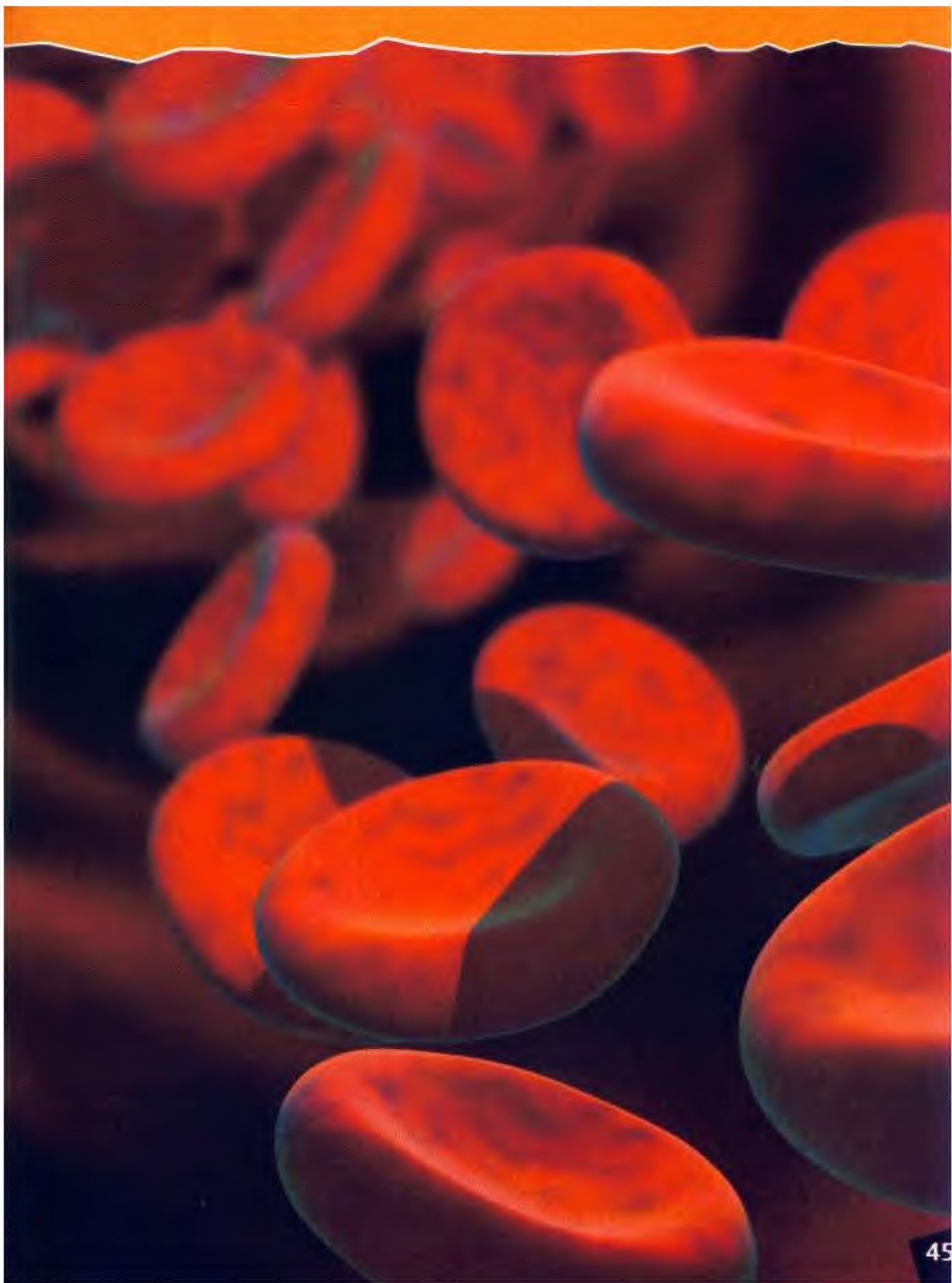


## Facts At A Glance

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- The largest part of the brain is the cerebrum. It accounts for 85 percent of the brain's weight.
- The heart is the main engine of the human body. It pumps blood through a 97,000-kilometre-long network of vessels.
- Around 7.2 million people die from heart diseases every year.
- The liver is the chemical factory of the human body. It processes nutrients that are later absorbed into the blood by the small intestine and forms glycogen and proteins also needed for blood.
- Human beings grow two sets of teeth. When the 20 baby teeth fall out, they are replaced by 32 adult teeth.
- Skin is the largest organ. Adults carry some 3.6 kg and 2 square metres of it.
- Fair skin is an **adaptation** found in people from northern latitudes where sun rays are weak.
- Human body sheds about 40,000 skin cells every minute.
- A chin dimple is very rare. It is the result of a dominant gene that very few people carry.
- The lungs are the only internal organs that are exposed to the outer world. About between 8,000 and 9,000 litres of air passes through lungs each day.
- The only organs that can float in water are the lungs.







## **Glossary**

---

**adaptation:** to change or conform oneself to a new or different conditions

**cavities:** soft decayed areas in teeth usually seen as black holes

**circulating:** to move through a space, circuit or system, and returning to the starting point

**contract:** to be struck by an illness

**hormones:** chemical substances created by the body that control many body functions

**impulse:** impulse is a wish or urge, especially a sudden one.

**infection:** uncontrolled growth of harmful and disease causing organism

**involuntary:** an action that takes place without the conscious choice of an organism

**onset:** the beginning or early stages

**pivot:** a point that supports something that turns

**ribcage:** the bony enclosing wall of the chest

**valve:** a structure in a hollow organ (like the heart) with a flap to make sure that there is a one-way flow of fluid through it

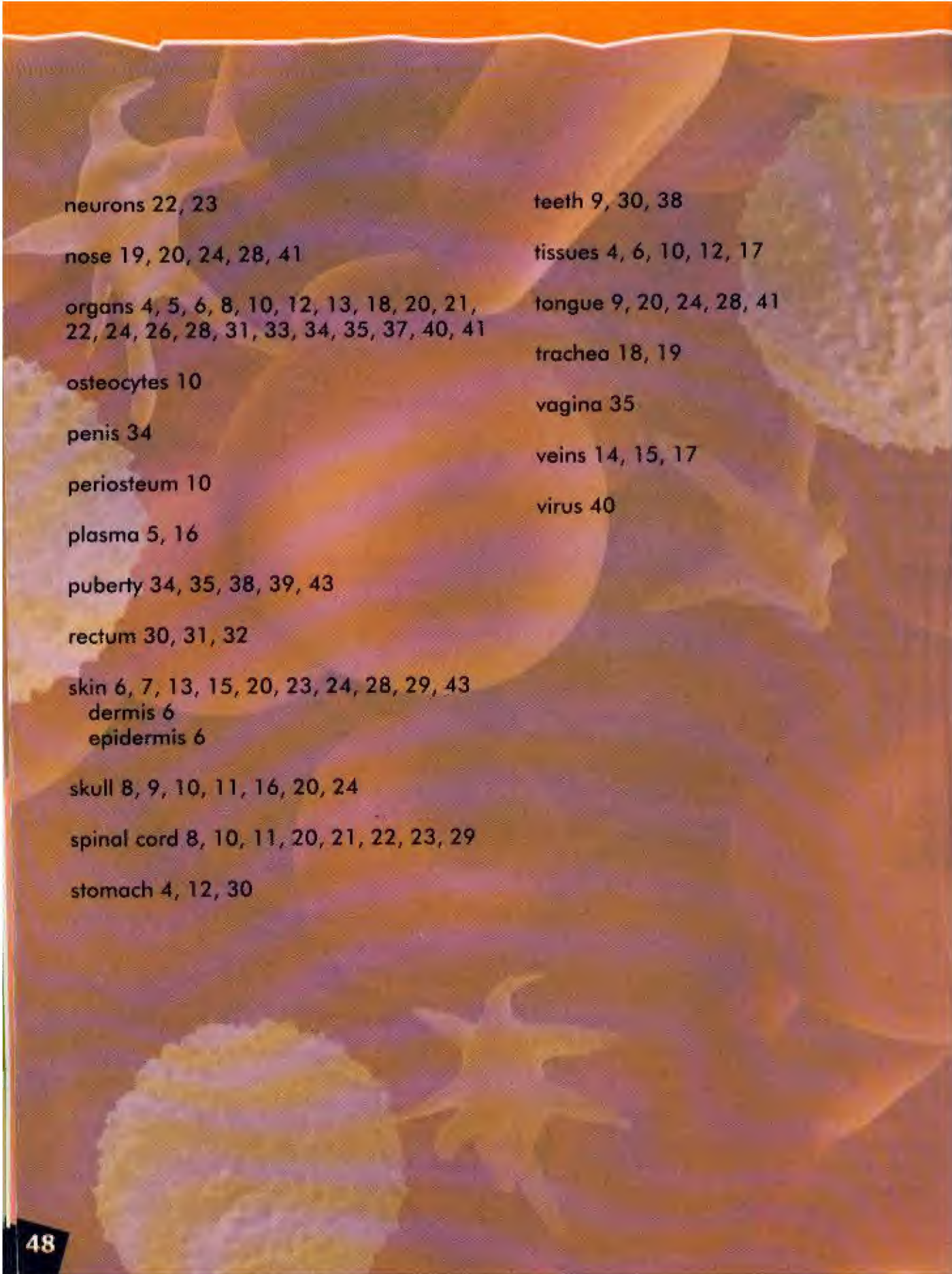
**vibrations:** a shaking to-and-fro motion



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